

High-Speed Rail Safety Program

The California High-Speed Rail Authority will create a 21st-century transportation system that will implement the most advanced and innovative safety technology available today. Below are just a few examples of how a ride on the California high-speed rail system will be among the safest train rides in the world.

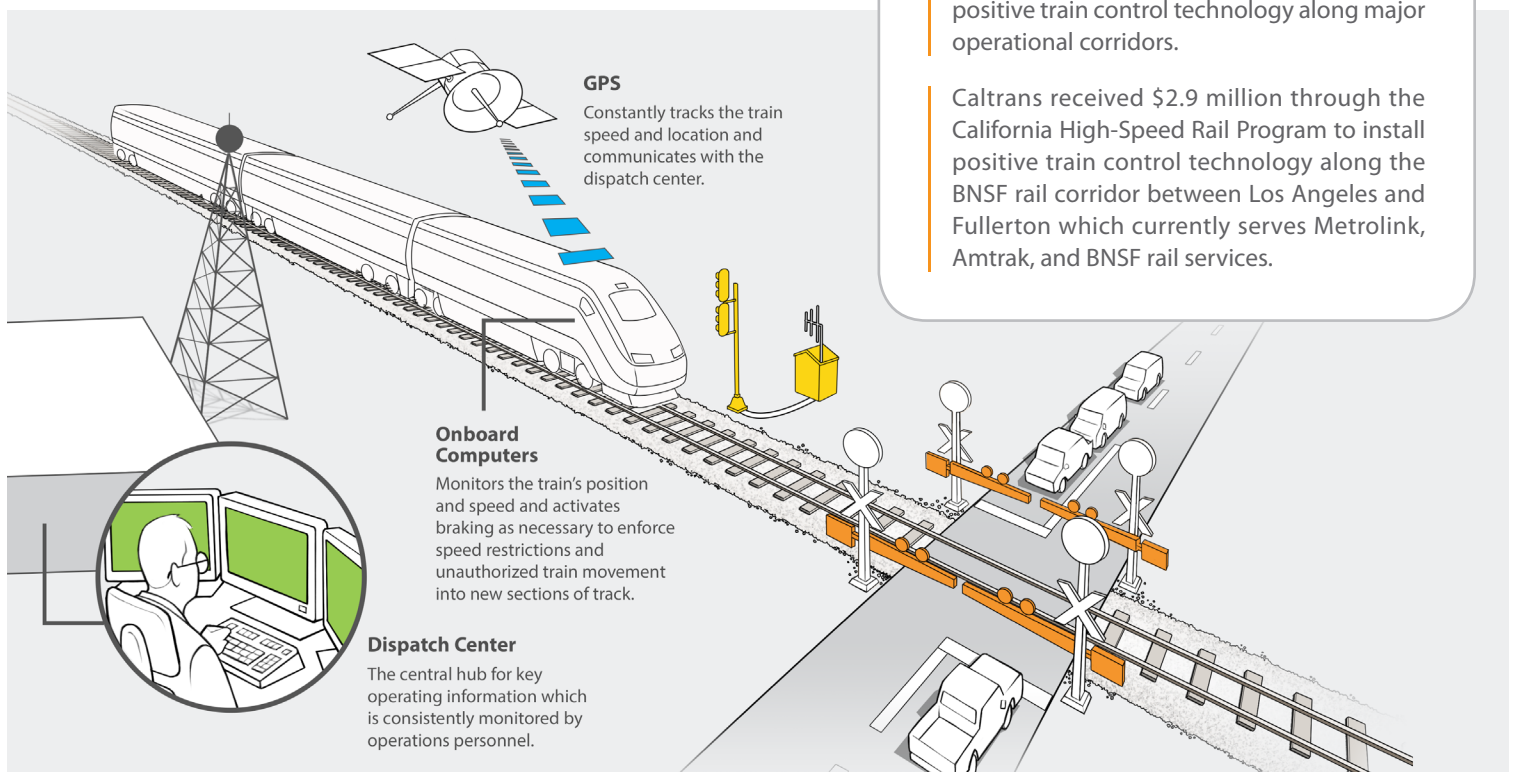
Positive Train Control (PTC)

Positive Train Control (PTC) is state-of-the-art collision avoidance technology that allows trains, tracks and dispatch centers to actively communicate using a fiber-optic network.

Through PTC, train engineers receive continuous information about speed restrictions, work zones and other safety impacts. For example, the PTC system would alert an engineer approaching a crossing where the crossing arms are malfunctioning.

With PTC, a train's onboard computer displays safe-braking distance based on speed, train length, weight and track curvature.

PTC also restricts speed limits and serves as a failsafe system. If the engineer doesn't respond, the PTC system takes over, thus preventing a train from running a red signal light or entering a stretch of track at an unsafe speed.



Quick Facts: How California High-Speed Rail is supporting PTC statewide

Metrolink, Southern California's 512-mile regional passenger rail network received \$81.5 million through the California High-Speed Rail Program, helping it become the first railroad in the nation to have its entire system in service with positive train control technology.

Caltrain, Northern California's main passenger rail service along the Bay Area peninsula, received \$105.4 million through the California High-Speed Rail Program to install positive train control technology along the operations corridor.

North County Transit District in San Diego County received \$41.8 million through the California High-Speed Rail Program to install positive train control technology along major operational corridors.

Caltrans received \$2.9 million through the California High-Speed Rail Program to install positive train control technology along the BNSF rail corridor between Los Angeles and Fullerton which currently serves Metrolink, Amtrak, and BNSF rail services.

Early Earthquake Warning

California has numerous active faults throughout the state that are known to produce large earthquakes.

To ensure that the high-speed rail system can operate safely in such a seismically-active area, the Authority will implement a comprehensive seismic safety program, including earthquake early-warning and appropriate operational responses.

The infrastructure that will support the high-speed rail program – such as bridges, tunnels, high-speed rail stations, and other facilities – will be built to meet all⁽¹⁾ state standards for earthquake design in California.

The Authority is adopting an Early Earthquake Detection System (EEDS) that will be designed to detect the initial wave produced by a seismic event, and immediately cut off power to trains in operation at the time of the earthquake. This process will allow for the inspection of tracks, bridges, and signals before resuming service.

The Authority is also partnering with first responders across the state to create a response plan that will provide appropriate assistance to all passengers and operators on high-speed rail during a seismic event.

Grade Separation

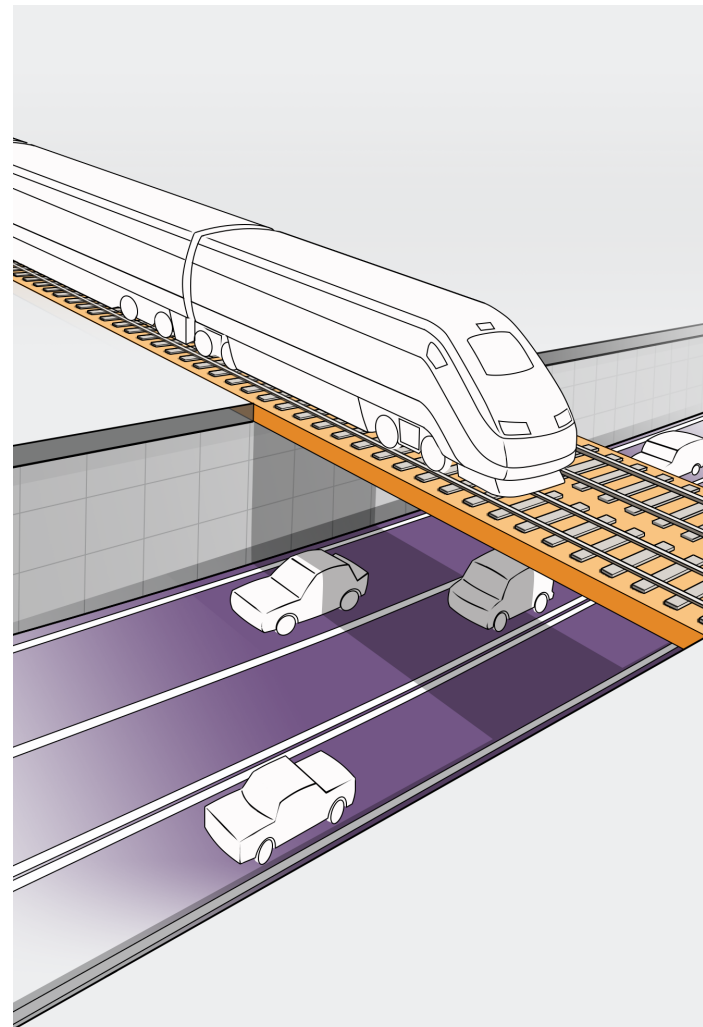
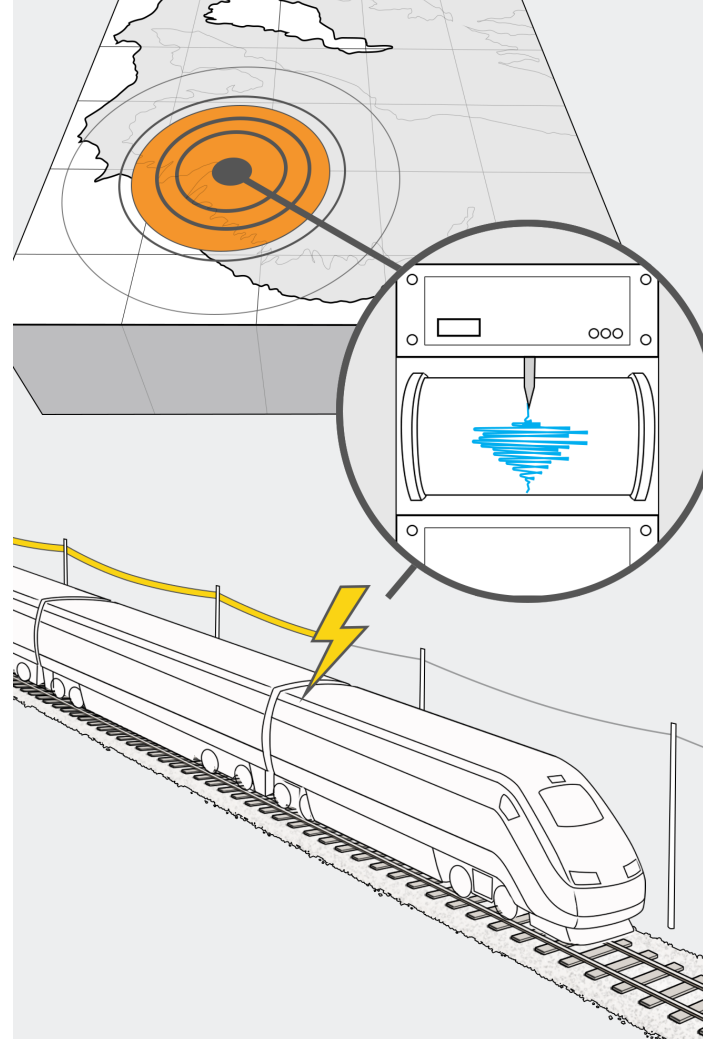
A grade separation is a roadway that is re-aligned over or under a railway to eliminate hazards. Benefits of grade separations include:

- Improved safety
- Reduced noise (no train horns)
- Decrease in traffic congestion
- Reduction in GHG emissions from idling vehicles
- Improved train operations reliability

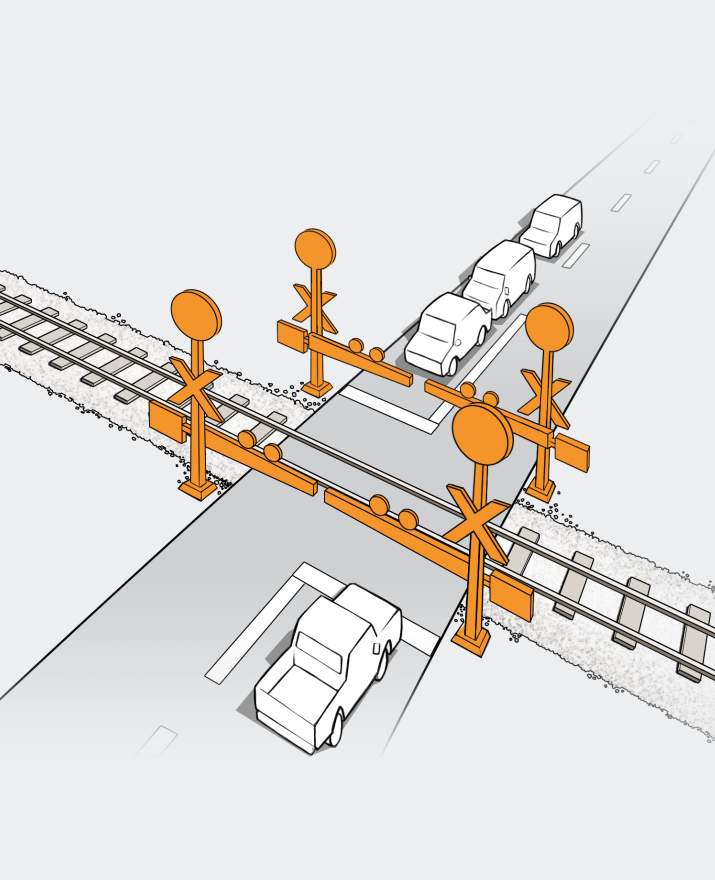
In the Central Valley, where trains will be capable of running at speeds in excess of 200 miles per hour, the high-speed rail system is being built fully grade separated. As part of this effort, 55 existing grade crossings with existing freight service will be eliminated. Within the first three construction packages, stretching approximately 119 miles from Madera to north of Bakersfield, there will be 39 BNSF Railway at-grade crossings eliminated and 16 existing Union Pacific Railroad crossings eliminated. This will result in major improvements to both urban and rural areas in the Central Valley.

In Northern California, as part of the environmental work being done to identify the final high-speed rail alignment from San Francisco to San Jose, the Authority is working with communities to accommodate a blended system with Caltrain. This blended system is currently being evaluated for traffic, safety, and noise impacts at existing at-grade crossings.

In Southern California, key early grade separation projects will include State College, Doran Street and Rosecrans Avenue/Marquardt Avenue grade crossings. In addition to these critical efforts, the Authority is also partnering



⁽¹⁾ Caltrans Seismic Design Criteria Version 1.7 (2013); American Railway Engineering and Maintenance-of-Way Association Manual, Ch. 9, seismic design for railway structures (2015)

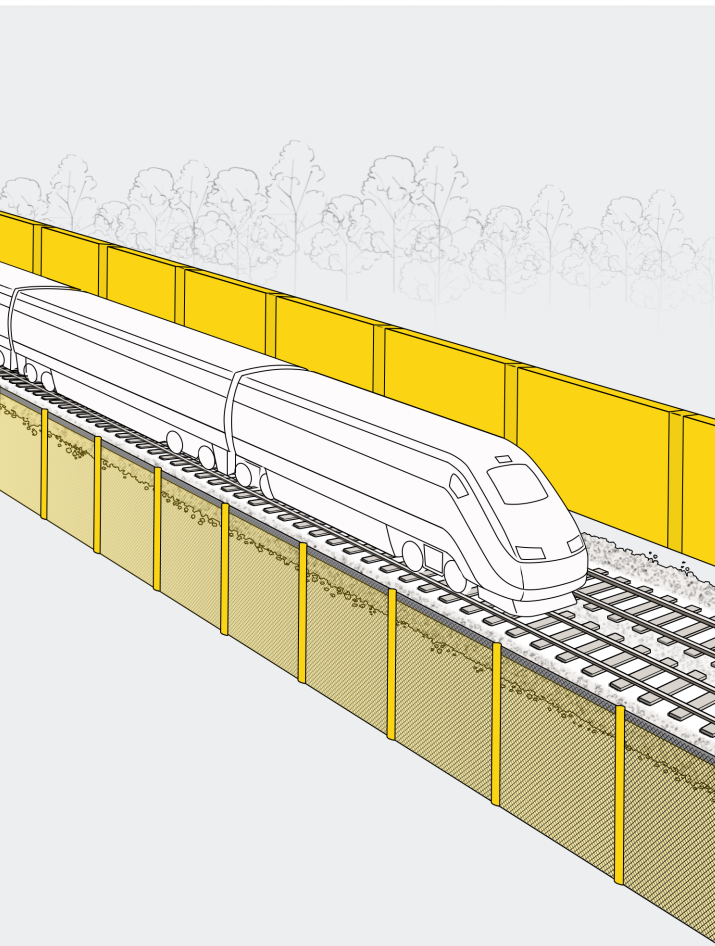


with various local agencies to evaluate other high-priority at-grade crossing projects in order to deliver safety and environmental benefits prior to the arrival of high-speed rail.

Quad Gates

The Authority will work with communities along the rail corridors to install safer rail crossings, such as 4 Quadrant Gates, or Quad Gates. Quad gates are designed to block all lanes of traffic on both sides of the track, and provide a closure delay on the exit side to allow vehicles that may get stuck between the gates to get off the tracks. Quad gates are also a temporary measure considering the entire high-speed train system is intended to eventually be fully grade-separated over time.

Quad gates have been shown to reduce collisions at-grade crossings by 98 percent ⁽²⁾.



Intrusion Barriers

The high-speed rail system will operate adjacent to or within the right-of-way of other transportation systems throughout the state. These transportation systems include passenger railroad lines, freight railroad lines and state or local highways and roadways. At these locations, assessments will determine the need for intrusion protection for the respective modes and services. Hazard analyses, risk assessments, and implementation of appropriate mitigations to reduce the potential for intrusion will allow the high-speed rail system to safely operate in proximity to existing transportation systems.

In the rural environment, the Authority will design fencing and other solutions that will minimize potential collisions and accidents. The Authority's bridges and tunnels will also be dedicated solely to high-speed trains, which will help eliminate potential hazards.

In addition to fencing, walls and other systems can be put into place that would not only help minimize noise and sightlines, but also prevent potential hazards within urban environments. The Authority is committed to working with communities and local jurisdictions to ensure that the barriers blend into the surrounding environments.

⁽²⁾ UC Berkeley Safe Transportation Education and Research Center